

**WHAT IS CLAIMED IS:**

1        1. A method of topographically mapping a surface, comprising:  
2            directing a radiation beam toward a target location on the surface;  
3            capturing an image of a beam spot at a location in an image plane  
4            intersecting at least a portion of the radiation beam reflected from the target  
5            location on the surface;  
6            identifying at least one image plane coordinate for a peripheral point of the  
7            beam spot image; and  
8            assigning a relative height value to the target location based on a mapping  
9            of the at least one image plane coordinate identified for the peripheral beam spot  
10          point to the relative height value.

1        2. The method of claim 1, wherein the radiation beam is directed along  
2          a beam axis and an image plane coordinate is identified with respect to a first  
3          direction substantially parallel to a projection of the beam axis onto the image  
4          plane.

1        3. The method of claim 2, wherein the peripheral point is located at a  
2          peripheral area of the beam spot closer to the beam axis than other comparable  
3          peripheral areas of the beam spot.

1        4. The method of claim 1, wherein identifying the at least one image  
2          plane coordinate comprises applying a threshold to pixel values of the beam spot  
3          image.

1        5. The method of claim 4, wherein a normalized grayscale threshold is  
2          applied to the pixel values of the beam spot image.

1        6. The method of claim 1, wherein assigning a relative height value to  
2          the target location comprises mapping the at least one image plane coordinate to a  
3          predetermined relative height value.

1        7. The method of claim 6, wherein the at least one image plane  
2          coordinate is mapped to the predetermined relative height value based on a  
3          lookup table.

1        8.     The method of claim 1, wherein the surface forms a boundary of a  
2 substrate and is semitransparent with respect to the radiation beam.

1        9.     The method of claim 8, wherein the substrate is a printed circuit  
2 board.

1        10.    The method of claim 9, further comprising repeating the steps of  
2 directing, capturing, identifying, and assigning for a plurality of target location on  
3 the surface of the printed circuit board arranged in a prescribed triangular mesh  
4 pattern.

1        11.    A system for topographically mapping a surface, comprising:  
2              a radiation source oriented to direct a radiation beam toward a target  
3 location on the surface;  
4              an imager oriented to capture an image of a beam spot at a location in an  
5 image plane intersecting at least a portion of the radiation beam reflected from the  
6 target location on the surface;  
7              a mapping engine operable to identify at least one image plane coordinate  
8 for a peripheral point of the beam spot image, and to assign a relative height  
9 value to the target location based on a mapping of the at least one image plane  
10 coordinate identified for the peripheral beam spot point to the relative height  
11 value.

1        12.    The system of claim 11, wherein the radiation source is oriented to  
2 direct the radiation beam along a beam axis, and the mapping engine is operable  
3 to identify an image plane coordinate with respect to a first direction substantially  
4 parallel to a projection of the beam axis onto the image plane.

1        13.    The system of claim 12, wherein the peripheral beam spot point is  
2 located at a peripheral area of the beam spot closer to the beam axis than other  
3 comparable peripheral areas of the beam spot.

1        14.    The system of claim 11, wherein the mapping engine is operable to  
2 identify the image plane coordinates by applying a threshold to pixel values of the  
3 beam spot image.

1        15. The system of claim 14, wherein the mapping engine is operable to  
2 apply a normalized grayscale threshold to the pixel values of the beam spot  
3 image.

1        16. The system of claim 11, wherein the mapping engine is operable to  
2 assign a relative height value to the target location by mapping the at least one  
3 image plane coordinate to a predetermined relative height value.

1        17. The system of claim 16, wherein the mapping engine is operable to  
2 map the at least one image plane coordinate to the predetermined relative height  
3 value based on a lookup table.

1        18. A computer program for topographically mapping a surface, the  
2 computer program residing on a computer-readable medium and comprising  
3 computer-readable instructions for causing a computer to:

4              identify at least one image plane coordinate for a peripheral point of a  
5 beam spot image captured at an image plane intersecting at least a portion of  
6 radiation beam reflected from a target location on the surface, and

7              assign a relative height value to the target location based on a mapping of  
8 the at least one image plane coordinate identified for the peripheral beam spot  
9 point to the relative height value.

1        19. The computer program of claim 18, wherein an image plane  
2 coordinate is identified with respect to a first direction substantially parallel to a  
3 projection onto the image plane of a beam axis of a radiation beam directed  
4 toward the target location, and the peripheral beam spot point is located at a  
5 peripheral area of the beam spot closer to the beam axis than other comparable  
6 peripheral areas of the beam spot.

1        20. The computer program of claim 18, wherein the at least one mage  
2 plane coordinate is identified by applying a threshold to pixel values of the beam  
3 spot image.